Claims

[c1] 1. A method for facilitating a reduction of speckle in a screen receiving light from a light source, said method comprising the steps of:
positioning at least one optical path distributing screen element such that the light originating from the light source passes through the screen element and emerges decorrelated from the screen element toward an audience space; and
positioning an angular distribution element between the screen element and the audience space such that the angular distribution element distributes the decorrelated light from the screen element toward the audience space.

[c2] 2. A method according to Claim 1 wherein said step of providing at least one optical path distributing element comprises the step of positioning at least one non-imaging optical path distributing screen element.

[c3] 3. A method according to Claim 1 wherein said step of positioning at least one optical path distributing element comprises the step of positioning at least one non-imaging optical path distributing screen element shaped such that a distribution of optical paths of light exiting the screen is at least two times a coherence length of the light.

[c4] 4. A method according to Claim 1 wherein said step of positioning at least one optical path distributing element comprises the step of positioning at least one non-imaging optical path distributing screen element comprising at least one non-imaging optical concentrator.

[c5] 5. A method according to Claim 4 wherein said step of positioning at least one non-imaging optical path distributing element comprises the step of positioning at least one of a non-imaging trapezoid concentrator and a non-imaging skew concentrator.

[c6] 6. A method according to Claim 4 wherein said step of positioning at least one non-imaging optical path distributing element comprises the step of positioning at least one ten by five degree trapezoid concentrator.

[c7] 7. A method according to Claim 4 wherein said step of positioning at least one

non-imaging optical path distributing element comprises the step of positioning at least one ten by five degree trapezoid concentrator comprising one of a polycarbonate, a polymethylmethacrylate, a polyester, a poly(4-methyl pentene) polystyrene, a polymer formed by photopolymerization of an acrylate monomer(s), and mixtures thereof.

[c8] 8. A method according to Claim 7 wherein said step of positioning at least one non-imaging optical path distributing element comprises the step of positioning at least one ten by five degree trapezoid concentrator comprising a polycarbonate having an index of refraction greater than about 1.40 and less than about 1.65.

[c9] 9. A method according to Claim 7 wherein said step of positioning at least one non-imaging optical path distributing element comprises the step of positioning at least one ten by five degree trapezoid concentrator comprising a polycarbonate having an index of refraction greater than about 1.50 and less than about 1.60.

[c10] 10. A method according to Claim 7 wherein said step of positioning at least one non-imaging optical path distributing element comprises the step of positioning at least one ten by five degree trapezoid concentrator comprising a polycarbonate having an index of refraction greater than about 1.55 and less than about 1.60.

[c11] 11. A method according to Claim 4 wherein said step of positioning at least one non-imaging optical path distributing element comprises the step of positioning at least one ten by five degree trapezoid concentrator having an index of refraction greater than about 1.1 and less than about 3.

[c12] 12. A method according to Claim 1 further comprising the step of attaching a field lens to the optical path distributing screen element and the angular distribution element to form an integral body.

[c13] 13. A method according to Claim 12 wherein said step of attaching a field lens comprises the step of attaching at least one of a holographic field lens and a

Fresnel field lens.

[c14] 14. A method according to Claim 1 further comprising the step of forming a unitary body with the optical path distributing screen element and the angular distribution element.

[c15] 15. A method according to Claim 1 wherein said step of positioning an angular distribution element further comprises the step of positioning an angular distribution element comprising a diffuser to distribute the decorrelated light from the screen element.

[c16] 16. A method according to Claim 1 wherein said step of positioning at least one optical path distributing screen element further comprises the step of positioning at least one imaging optical path distributing element having an exit angle between twenty-five percent and two-hundred percent of a diffusion angle of the angular distribution element.

[c17] 17. A method according to Claim 1 wherein said step of positioning at least one optical path distributing screen element further comprises the step of positioning at least one imaging optical path distributing element having an exit angle, said step of positioning an angular distribution element further comprises the step of positioning an angular distribution element having a diffusion angle substantially equal to the exit angle between the screen element and the audience space such that the angular distribution element distributes the decorrelated light from the screen element.

[c18] 18. A method according to Claim 1 wherein said step of positioning at least one optical path distributing element further comprises the step of positioning at least one optical path distributing element including a reflecting layer.

[c19] 19. A method according to Claim 1 wherein said step of positioning at least one optical path distributing element further comprises the step of positioning at least one optical path distributing element including an absorbing layer.

[c20] 20. A method according to Claim 1 wherein said step of positioning at least one

optical path distributing element further comprises the step of positioning at least one optical path distributing element including a reflecting layer and an absorbing layer such that the absorbing layer is between the reflecting layer and the audience space.

[c21] 21. A method according to Claim 1 wherein said step of positioning at least one optical path distributing element further comprises the step of positioning at least one optical path distributing element including a reflecting layer including a bulk absorber.

[c22] 22. A method for facilitating a reduction of speckle in a projection television screen, said method comprising the steps of:
providing a plurality of optical path distributing screen elements each including a light-incidence light engine side and a light-emergence audience side, the screen elements shaped such that a distribution of optical paths of light exiting at least eighty percent of the screen elements from the audience side is at least two times the coherence length of the light; and
positioning a plurality of diffuser elements between the screen elements and an audience space such that the diffuser elements distribute decorrelated light emerging from the screen elements toward an audience space.

[c23] 23. A method according to Claim 22 wherein said step of providing comprises the step of providing a plurality of non-imaging optical path distributing screen elements each including a light-incidence light engine side and a light-emergence audience side, the screen elements shaped such that a distribution of optical paths of light exiting at least ninety percent of the screen elements from the audience side is at least two times the coherence length of the light.

[c24] 24. A method according to Claim 22 wherein said step of providing comprises the step of providing a plurality of non-imaging optical path distributing screen elements each including a light-incidence light engine side and a light-emergence audience side, the screen elements shaped such that a distribution of optical paths of light exiting substantially all of the screen elements from the audience side is at least two times the coherence length of the light.

Exhibit 1008

[c25] 25. A method according to Claim 22 wherein said step of providing comprises the step of providing a plurality of imaging optical path distributing screen elements each including a light-incidence light engine side and a light-emergence audience side, the screen elements shaped such that a distribution of optical paths of light exiting at least ninety percent of the screen elements from the audience side is at least two times the coherence length of the light.

[c26] 26. A method according to Claim 22 wherein said step of providing further comprises the step of providing a plurality of imaging optical path distributing screen elements each including a light-incidence light engine side and a light-emergence audience side, the screen elements shaped such that a distribution of optical paths of light exiting substantially all of the screen elements from the audience side is at least two times the coherence length of the light.

[c27] 27. A rear projection television comprising:
a housing;
a light engine positioned in said housing; and
a screen positioned between said light engine and an audience space, said screen mounted to said housing and comprising:
a field lens;
at least one optical path distributing screen elementoperationally coupled to said field lens; and
at least one angular distribution element operationally coupled to said non-imaging optical screen element and positioned such that said angular distribution element distributes a decorrelated light emerging from said screen element toward the audience space.

[c28] 28. A rear projection television according to Claim 27 wherein said optical path distributing screen element comprises a non-imaging element shaped such that a distribution of optical paths of light exiting said screen is at least two times a coherence length of the light.

[c29] 29. A rear projection television according to Claim 24 wherein said optical path distributing screen element comprises at least one non-imaging optical path

distributing element.

[c30] 30. A rear projection television according to Claim 29 wherein said non-imaging optical concentrator comprises at least one of a non-imaging trapezoid concentrator and a skew concentrator.

[c31] 31. A rear projection television according to Claim 29 wherein said non-imaging optical concentrator comprises at least one substantially ten by five degree trapezoid concentrator.

[c32] 32. A rear projection television according to Claim 29 wherein said non-imaging optical concentrator comprises at least one substantially ten by five degree trapezoid concentrator comprising one of a polycarbonate, a polymethylmethacrylate, a polyester, a poly(4-methyl pentene) polystyrene, a polymer formed by photopolymerization of an acrylate monomer(s), and mixtures thereof.

[c33] 33. A rear projection television according to Claim 32 wherein said non-imaging optical concentrator comprises a polycarbonate having an index of refraction greater than about 1.40 and less than 1.65.

[c34] 34. A rear projection television according to Claim 32 wherein said non-imaging optical concentrator comprises a polycarbonate having an index of refraction greater than about 1.50 and less than 1.60.

[c35] 35. A rear projection television according to Claim 32 wherein said non-imaging optical concentrator comprises a polycarbonate having an index of refraction greater than about 1.55 and less than 1.60.

[c36] 36. A rear projection television according to Claim 29 wherein said non-imaging optical concentrator comprises at least one substantially ten by five degree trapezoid concentrator having an index of refraction greater than about 1.1 and less than 3.0.

[c37] 37. A rear projection television according to Claim 32 wherein said non-imaging optical path distributing element operationally coupled to said angular

distribution element forming an integral body.

[c38] 38. A rear projection television according to Claim 27 wherein said non-imaging element operationally coupled to said angular distribution element forming a unitary body.

[c39] 39. A rear projection television according to Claim 27 wherein said angular distribution element comprises a diffuser.

[c40] 40. A rear projection television according to Claim 27 wherein said optical path distributing screen element comprises at least one imaging optical path distributing element.

[c41] 41. A rear projection television according to Claim 27 wherein said optical path distributing element comprises a reflecting layer.

[c42] 42. A rear projection television according to Claim 27 wherein said optical path distributing element comprises an absorbing layer.

[c43] 43. A rear projection television according to Claim 27 wherein said optical path distributing element comprises a reflecting layer and an absorbing layer such that said absorbing layer is between said reflecting layer and the audience space.

[c44] 44. A rear projection television according to Claim 27 wherein said optical path distributing element comprises a reflecting layer comprising a bulk absorber.

[c45] 45. A screen for a rear projection television, said screen comprising:
a light engine side comprising at least one optical path distributing screen element; and
an audience side comprising at least one angular distribution element positioned such that said angular distribution element distributes decorrelated light emerging from said screen element toward an audience space.

[c46] 46. A screen according to Claim 45 wherein said optical path distributing element comprises a non-imaging element shaped such that a distribution of

optical paths of light exiting said screen is at least two times a coherence length of the light.

[c47] 47. A screen according to Claim 45 wherein said optical path distributing element comprises at least one non-imaging optical concentrator.

[c48] 48. A screen according to Claim 47 wherein said non-imaging optical concentrator comprises at least one of a non-imaging trapezoid concentrator and a non-imaging skew concentrator.

[c49] 49. A screen according to Claim 47 wherein said non-imaging optical concentrator comprises at least one ten by five degree trapezoid concentrator.

[c50] 50. A screen according to Claim 47 wherein said non-imaging optical concentrator comprises at least one ten by five degree trapezoid concentrator comprising one of a polycarbonate, a polymethylmethacrylate, a polyester, a poly(4-methyl pentene) polystyrene, a polymer formed by photopolymerization of an acrylate monomer(s), and mixtures thereof.

[c51] 51. A screen according to Claim 47 wherein said non-imaging optical concentrator comprises at least one ten by five degree trapezoid concentrator having an index of refraction greater than about 1.1 and less than about 3.0.

[c52] 52. A screen according to Claim 50 wherein said ten by five degree trapezoid concentrator comprises a polycarbonate having an index of refraction greater than about 1.40 and less than 1.65.

[c53] 53. A screen according to Claim 50 wherein said ten by five degree trapezoid concentrator comprises a polycarbonate having an index of refraction greater than about 1.50 and less than 1.60.

[c54] 54. A screen according to Claim 50 wherein said ten by five degree trapezoid concentrator comprises a polycarbonate having an index of refraction greater than about 1.55 and less than 1.60.

[c55] 55. A screen according to Claim 47 wherein said non-imaging optical

concentrator operationally coupled to said angular distribution element forming an integral screen.

[c56] 56. A screen according to Claim 47 wherein said non-imaging optical concentrator operationally coupled to said angular distribution element forming a unitary screen.

[c57] 57. A screen according to Claim 45 wherein said angular distribution element comprises a diffuser.

[c58] 58. A screen according to Claim 45 wherein said optical path distributing element comprises an imaging element shaped such that a distribution of optical paths of light exiting said screen is at least two times a coherence length of the light.

[c59] 59. A screen according to Claim 45 wherein said optical path distributing element comprises a reflecting layer.

[c60] 60. A screen according to Claim 45 wherein said optical path distributing element comprises an absorbing layer.

[c61] 61. A screen according to Claim 45 wherein said optical path distributing element comprises a reflecting layer and an absorbing layer such that said absorbing layer is between said reflecting layer and the audience space.

[c62] 62. A screen according to Claim 45 wherein said optical path distributing element comprises a reflecting layer comprising a bulk absorber.

[c63] 63. A unitary screen for a rear projection television, said screen comprising:
a light engine side comprising at least one non-imaging optical screen element comprising a substantially ten by five degree trapezoid concentrator comprising a polycarbonate having an index of refraction of about 1.59; and
an audience side comprising at least one diffuser element positioned such that said angular distribution element distributes decorrelated light emerging from said screen element toward an audience space, said trapezoid concentrator shaped such that a distribution of optical paths of light exiting said screen is at

least two times a coherence length of the light.